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AUTHOR Feldmann, Shirley C.; And Others
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ABSTRACT

This observational study examined student and teacher verbal and nonverbal behaviors in microcomputer classrooms in a high school where most of the students are Black, Hispanic, or Asian, and almost half of them are classified as economically disadvantaged. A total of 125 students in grades 9 to 12 were observed, with 47 students in marketing, 18 in social studies, 29 in English, and 31 in stenography classes. The objectives of the study were to determine: (1) the effects on student behavior of grouping at the computer (individual or paired), student keyboard status (keyboarding, not keyboarding, taking turns), gender, type of class, gender of partner if applicable, and academic discipline; and (2) the effects on teacher behavior of student grouping at the computer (individual or paired), student gender, and academic discipline. The study provides evidence that two contextual variables--student grouping at the computer and academic discipline--seem to be related to social processes in the computer classroom. These variables produced variations in the nature and frequency of student behaviors, with students who were paired being more verbally active and showing more positive reactions to their work. There were also differing responses across disciplines, probably linked to the particular curriculum that was observed. Teachers involved in whole class activities, as compared to individual interactions, gave a higher than expected frequency of procedural information. Results of analyses of the data are displayed in 22 tables. (5 references) (GL)

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An Observational Study of Social Processes In Microcomputer Classrooms

Shirley C. Feldmann

Marian C. Fish

Rosalie Friend

Linda Bastone

Graduate School of the City University of New York

Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, March 28, 1989.

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An Observational Study of Social Processes

In Microcomputer Classrooms

This observational study examined student and teacher verbal and nonverbal behaviors in high school microcomputer classrooms. The objectives of the study were (1) to determine the effect of grouping at the computer (individual or paired), student keyboard status (keyboarding, not keyboarding, taking turns), gender, type of class, gender of partner if applicable, and academic discipline (Marketing, Stenography, English, and Social Studies) on student behavior, and (2) to determine the effect of student grouping at the computer (individual or paired), student gender and academic discipline on teacher behavior.

There is some evidence that the use of microcomputers modifies teacher-student patterns of classroom interaction (Becker, 1983). In several recent studies verbal behavior in microcomputer contexts has been examined (Fish & Feldmann, 1987; Hawkins, Sheingold, Gearhart & Berger, 1982; Webb, Ender & Lewis, 1986). Fish and Feldmann (1987) found that elementary and junior high school students in microcomputer settings verbalized more and their talk was more task-focused than their peers in recitation and group-work settings. In addition, they found that the role of the teacher in the microcomputer classroom appears to be one of providing information; otherwise microcomputer teachers had a consistently lower level of verbalizations as compared to teachers in the other two settings. Zimmerman and Smith (1987) looked at the impact of instructional uses of microcomputers on high school students and teachers through a series of interviews and surveys. The interview data

indicated that students were more likely to work together in the computer room than in noncomputer classes. Also, there was considerable cooperation and assistance-giving in the computer classroom between students, and frequent help-giving by teachers.

This observational study was undertaken to follow up and elaborate on the Zimmerman and Smith study and to examine the influence of contextual variables such as academic discipline and computer grouping (individual or paired) on student and teacher social behaviors.

As in Phase I, this study assumes that the nature of the classroom and its organization affects the social interactions, which include both verbal and affective behaviors occurring in that setting. Thus, a number of variables as listed above were examined using a systematic observation schedule in computer classes. Both student and teacher social behavior were observed. The following questions were addressed in this study:

(1) Does student social behavior vary by gender in computer classes?

(2) Does student social behavior vary by student grouping at the computer, that is, individual vs. paired, in computer classes?

(3) Does student social behavior vary by keyboard usage, that is, whether one is keyboarding, not keyboarding or taking turns, in computer classes?

(4) Does student social behavior vary by type of class? (Vocational Improvement Program - VIP or Municipal Assistance Corporation Classrooms - MAC).

(5) Does student social behavior vary by discipline, that is, in English, Social Studies, Marketing, or Stenography computer classes?

(6) Does student social behavior vary by student gender in computer classes?

(7) Does teacher social behavior vary by student gender in computer classes?

(8) Does teacher social behavior vary by student grouping, that is, individual vs. paired, in computer classes?

(9) Does teacher social behavior vary in VIP vs. MAC classes?

(10) Does teacher social behavior vary by academic discipline in computer classes?

Method

Observational Setting

The study was conducted in the spring of 1988 at one of the "options" schools of a major urban center, a public business high school that draws applications from junior high schools in all areas of the city. Admission of half the entering class is by random selection while the other half is chosen based on criteria of attendance, punctuality, junior high grades (emphasizing grades in subjects pertinent to the student's major), and order of choice (i.e., those who put this school as first choice are given preference).

All students use computers in their business and secretarial courses, and computers are used by the English, Foreign language, and Social Studies departments as well.

Two kinds of computer settings were used in the study. In VIP rooms, used for stenography classes, students worked individually on Tandy 1000 computers. The software used in the stenography classes was Easywrite. In MAC rooms, students worked both individually and in pairs at Apple IIe computers; these rooms were used for a variety of courses

including Marketing, English and Social Studies. The software used in Marketing classes was Appleworks, and in English classes it was Freewriter and Appleworks. The Social Studies students used a decision-making game, "Beyond the Rising Sun."

Students were observed while doing their regular assignments during regularly scheduled computer laboratory periods. Stenography classes met daily while Marketing classes met three times a week for the semester and the English and Social Studies classes had scheduled laboratory time for special curriculum units.

Subjects

Students The school population is 45% Black, 45% Hispanic, 7% Asian, and 3% white or other. Forty to fifty percent of the students are classified as disadvantaged, being eligible for free lunch. Many classes have unequal sex distribution because the student body is 65% female. Enrollment in the secretarial major is almost 100% female.

A total of 125 students in grades 9 to 12 were observed for this study with 47 students in Marketing classes, 18 in Social Studies classes, 29 in English classes, and 31 students in Stenography classes.

Teachers Seven teachers participated in the study: two each in Marketing, English, and Stenography, and one in Social Studies. All but one were very experienced teachers. There was one substitute teacher, experienced in the subject and working from lesson plans left by the regular teacher. All teachers were familiar with the computers and the software.

Instrument

The observational coding system consisted of ten student categories and eight teacher categories, which are summarized in Table 1. Student

categories include questions about content or procedures, information about content or procedures, positive or negative affect shown or expressed by the student, writing, reading aloud, miscellaneous verbal output, and off task behavior. Teacher categories were similar, with positive and negative affect replaced by approval and disapproval, and writing and reading aloud were omitted. The observation instrument was based on a coding system developed by Fish and Feldmann (1987) for classroom observation. To revise the instrument, detailed notes were made of student behavior in high school Business Computer Applications, Foreign language and English classes in the Fall 1987. These observed behaviors were classified and coding categories were added to the original observation scale where necessary; this instrument was then field tested and further modified until it represented typical behaviors of students and teachers in the classes. Classes used in the final study in May 1988 were not used during instrument development.

Procedure

Subjects for observation were selected randomly by the observers in each class using alternate groupings, i.e., working alone or in a pair, as well as gender. Observations were made during twenty-second intervals for a total of four minutes. Thus each student was observed for twelve intervals of twenty seconds each, during which behaviors were coded in any of the appropriate categories. Teacher behaviors were coded when his/her actions involved the student being observed, including whole class actions.

Data were collected in classes taught by their regular teachers, with one exception, when a stenography class was taught by an experienced substitute using work prepared by the regular teacher.

Observers did not participate in any class activities or answer questions directed to them.

Observer training and reliability

The two observers who field tested the observation instrument also carried out the observations for the study. Observers had undergone training in the use of the instrument and, in addition, had used it previously in another study.

Interrater reliabilities established before the study began were over 80% for each of the categories in the instrument.

Results

Social behavior was measured by the ten student and eight teacher coding categories (see Table 1); these were used as the dependent variables in this study. Independent variables used in the study were gender of student, grouping at the computer (individual or paired), the gender of the partner if paired, keyboarding status (keyboarding, not keyboarding or taking turns), type of class (VIP or MAC), academic discipline (English, Marketing, Social Studies or Stenography), and teacher activity (whole class, individual or neither). The effects of these independent variables on the various social behaviors were analyzed using nonparametric procedures (i.e., chi square analyses) because it was found that responses in each category were not normally distributed. Responses for the ten student dependent variables were divided into three categories by frequency of occurrence: 0, 1-3, and 4 or more responses. Responses for the eight teacher dependent variables were divided into two categories only, 0 and 1 or more responses, because of their relative infrequency of occurrence.

The social behaviors of students were examined first. Chi square analyses with m columns and n rows were performed. In each of these analyses the columns were the independent variables and the rows were the dependent variables. Using this procedure, it was found that there were no significant gender differences in the ten student behaviors nor did the gender of the partner in a computer grouping affect any of the behaviors. There were significant chi square values for student groupings at the computer, that is, individual or paired, for content information, $X^2(2, N = 124) = 19.41$, $p < .02$, procedural information, $X^2(2, N = 124) = 8.47$, $p < .02$, reading aloud, $X^2(2, N = 124) = 7.75$, $p < .03$, writing $X^2(2, N = 124) = 7.46$, $p < .03$, showing positive affect, $X^2(2, N = 124) = 15.2$, $p < .01$. Tables 2 through 6 show the observed frequency of the students in each of the cells. Significant chi square values for keyboarding activities were found for content information, $X^2(4, N = 122) = 21.24$, $p < .01$, procedural information, $X^2(4, N = 122) = 11.34$, $p < .03$, reading aloud, ($X^2(4, N = 122) = 21.35$, $p < .01$, writing, $X^2(4, N = 122) = 13.52$, $p < .02$, showing positive affect, $X^2(4, N = 122) = 22.59$, $p < .01$, and off task behavior, $X^2(4, N = 122) = 11.35$, $p < .03$. Tables 7 through 12 show the obtained frequency of the students in each of the cells. A significant chi square value was found when comparing type of classroom, VIP and MAC classes, for procedural questions, $X^2(2, N = 125) = 9.98$, $p < .02$, content information $X^2(2, N = 125) = 8.69$, $p < .02$, and procedural information, $X^2(2, N = 125) = 13.39$, $p < .01$. Tables 13 through 15 show the obtained frequency of the students in each of the cells. When the four academic disciplines were compared, there were significant chi square values for procedural

questions, $X^2(6, \underline{N} = 125) = 19.62$, $p < .01$, content information, $X^2(6, \underline{N} = 125) = 17.38$, $p < .02$, procedural information, $X^2(6, \underline{N} = 125) = 14.56$, $p < .03$, reading aloud, $X^2(6, \underline{N} = 125) = 24.67$, $p < .01$, writing, $X^2(6, \underline{N} = 125) = 38.62$, $p < .01$, showing positive affect, $X^2(6, \underline{N} = 125) = 17.15$, $p < .02$, and off task behavior, $X^2(6, \underline{N} = 125) = 13.42$, $p < .05$). The observed frequency of the students in each of the cells is shown in Tables 16 through 22.

One significant chi square value was found for teacher activity and procedural information, $X^2(2, \underline{N} = 125) = 8.22$, $p < .02$ (see Table 23). There were no other significant relationships for teacher behaviors.

Discussion

These findings reveal differences in student behaviors in various educational contexts. Those working alone at the computer had a greater probability of no occurrence of information giving, both content and procedural, no reading aloud or writing and no showing of positive affect. When students worked in pairs at the computer, they had higher than expected frequencies for information giving, both content and procedural, showing positive affect, reading aloud and writing. There is indication that working with a partner produced more verbal exchange of information. The reading aloud, writing and positive affect suggests more collaboration and more obvious expressions of satisfaction for pairs as contrasted to those students who worked alone. Data also indicate that student groupings were very stable, with all but one student working consistency alone or in a pair throughout the four minute observations.

These findings were corroborated by the keyboarding data. When students were keyboarding, whether alone or paired, there was a lower

than expected frequency of information giving, reading aloud, writing, positive affect and off task behavior. Students who were not keyboarding had a higher than expected probability of writing and off task behavior. Those who were taking turns at the computer had a higher than expected frequency of information giving, reading aloud, writing and positive affect. It seems that the role of the keyboarder is primarily computer directed, whether alone or in pairs, but still he/she has a fair amount of off task behavior. This off task behavior is also seen by the partner in the pair who is not keyboarding. The partner as well has a higher frequency of writing. When paired students were taking turns at the computer, the frequency of information giving, reading aloud, writing and positive affect was higher than expected. Thus, not only did pairing produce more social behaviors, but also taking turns when paired increased the probability of these same behaviors.

The results indicate that there are differences in social behaviors by academic discipline. It should be pointed out, however, that the stenography classes and VIP classes are the same group. Students consistently worked alone in stenography classes on long-term assignments. This is reflected in their lower-than-expected frequency of responses for procedural questions, information giving, both content and procedural, reading aloud, writing, showing positive affect and off task behavior. In this group working alone at the computer is primarily task directed. Students in Social Studies classes had higher than expected occurrences of content information giving, reading aloud, writing, and positive affect, and were lower than expected on off task behavior. This may be a reflection of the interest in and interactive

nature of the simulation program they were using. In English classes students had higher than expected frequencies of procedural questions and procedural information. The comparison of VIP (Stenography) and MAC (English, Social Studies, and Marketing) classes involved students who were working alone in the VIP classes and in MAC classes where pairs and individuals were observed. As expected, MAC classes had higher incidences of procedural questions, and content and procedural information statements.

When teachers were involved in whole class activities, as compared to individual interactions or other activities, a higher than expected frequency of procedural information was given. Overall, few teacher behaviors were observed perhaps because in classes observed most students worked independently at the computer. Since observations were made toward the end of the academic year, when students were used to computer work, this may have contributed to the limited interaction observed.

The contextual variables that seemed to be related to social processes in computer classrooms are student grouping and the academic discipline. These produced variations in the nature and frequency of student behaviors, with paired groupings being more verbally active and showing more positive reactions to their work. There were also differing behavior responses across disciplines, probably linked to the particular curriculum that was observed.

In conclusion, the study gives evidence that two contextual variables, student grouping at the computer and academic discipline, seem to be related to social processes in computer classroom. These produced variations in the nature and frequency of student behaviors,

with students who were paired being more verbally active and showing more positive reactions to their work. There were also differing behavior responses across disciplines, probably linked to the particular curriculum that was observed.

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Table 1

Coding Categories for Student and Teacher Behavior Instruments

Category	Description	Instrument
Questions:		
Content	The speaker seeks information in the form of a question related to the substantive content of the lesson or activity (e.g., How much is 6 X 3? Why did New York become a commercial center? How do you spell forward?).	Student, Teacher
Procedural	The speaker seeks information in the form of a question on a non-substantive procedure to follow (e.g., How do you turn off the machine? Where is the pencil?).	Student, Teacher
Information Giving		
Content	The speaker provides information related to the substantive content of the lesson or activity (e.g., The pioneers suffered many hardships. The numbers must be added).	Student, Teacher
Procedural	The speaker provides information on a non-substantive procedure to follow (e.g., Hold down the tab. You need a sharpener).	Student, Teacher
Reading Aloud	The student reads material verbatim.	Student
Writing	The student uses a pencil or pen to write on paper.	Student
Positive Affect	The student displays affect verbally and/or through gesture, motion or facial expression revealing pleasure, joy, or positive feelings (e.g., Terrific. Student raises hand denoting success).	Student

Negative Affect	The student displays affect verbally and/or through gesture, motion or facial expression revealing displeasure,unhappiness, or negative feeling (e.g., Oh darn. Student turns thumbs down).	Student
Approval	The teacher indicates praise or encouragement (e.g., Good, you got it! You're working very well! Nice job!)	Teacher
Disapproval	The teacher indicates criticism, reproach, or disapproval, (e.g. You're not trying. That's wrong! You could do better).	Teacher
Miscellaneous	The speaker makes a statement that does not fit into the other categories, but is task related. This includes exclamations such as Gee! Uh huh, All right, and Wow, as well as statements such as That's pretty.	Student, Teacher
Off Task	The student makes a statement, asks a question, acts or moves in such a way that the content is not related to the lesson activity either substantively or procedurally, (e.g., This is my new bracelet. Did you see the game yesterday?).	Student, Teacher

Table 2

Frequency of Students by Student Grouping Making Content Information Statements

	Student Grouping	
Number of Occurrences	Individual	Paired
None	74	25
1-3	7	15
4 or more	5	3

Table 3

Frequency of Students by Student Grouping Making Procedural Information Statements

	Student Grouping	
Number of Occurrences	Individual	Paired
None	47	17
1-3	29	16
4 or more	5	10

Table 4

Frequency of Students by Student Grouping Reading Aloud

Number of Occurrences	Individual	Paired
None	66	29
1-3	15	10
4 or more	0	4

Table 5

Frequency of Students by Student Grouping Doing Writing

Number of Occurrences	Individual	Paired
None	73	33
1-3	3	8
4 or more	5	2

Table 6

Frequency of Students by Student Grouping Showing Positive Affect

Number of Occurrences	Individual	Paired
None	73	26
1-3	8	17
4 or more	0	0

Table 7

Frequency of Students by Keyboarding Activity Making Content Information Statements

Number of Occurrences	Keyboarding	Not Keyboarding	Taking Turns
None	86	8	4
1-3	13	2	7
4 or more	1	1	0

Table 8

Frequency of Students by Keyboarding Activity Making Procedural Information Statements

Number of Occurrences	Keyboarding	Not Keyboarding	Taking Turns
None	53	6	3
1-3	39	2	4
4 or more	8	3	4

Table 9

Frequency of Students by Keyboarding Activity Reading Aloud

Number of Occurrences	Keyboarding	Not Keyboarding	Taking Turns
None	82	8	4
1-3	18	2	5
4 or more	0	1	2

Table 10

Frequency of Students by Keyboarding Activity Doing Writing

Number of Occurrences	Keyboarding	Not Keyboarding	Taking Turns
None	90	6	8
1-3	6	3	2
4 or more	4	2	1

Table 11

Frequency of Students by Keyboarding Activity Showing Positive Affect

Number of Occurrences	Keyboarding	Not Keyboarding	Taking Turns
None	86	8	3
1-3	14	3	8
4 or more	0	0	0

Table 12

Frequency of Students by Keyboarding Activity Showing Off Task Behavior

Number of Occurrences	Keyboarding	Not Keyboarding	Taking Turns
None	65	7	8
1-3	28	0	2
4 or more	7	4	1

Table 13

Frequency of Students by Type of Classroom Asking Procedural Questions

	Type of Classroom	
Number of Occurrences	VIP	MAC
None	28	54
1-3	3	35
4 or more	0	5

Table 14

Frequency of Students by Type of Classroom Making Content Information Statements

Number of Occurrences	Type of Classroom VIP	MAC
None	31	69
1-3	0	22
4 or more	0	3

Table 15

Frequency of Students by Type of Classroom Making Procedural Information Statments

Number of Occurrences	Type of Classroom VIP	MAC
None	25	39
1-3	5	41
4 or more	1	14

Table 16

Frequency of Students by Academic Discipline Asking Procedural Questions

	Academic Discipline			
Number of Occurrences	English	Social Studies	Marketing	Stenography
None	16	15	23	28
1-3	13	13	19	3
4 or more	0	0	5	0

Table 17

Frequency of Students by Academic Discipline Making Content Information Statements

	Academic Discipline			
Number of Occurrences	English	Social Studies	Marketing	Stenography
None	24	9	36	31
1-3	4	8	10	0
4 or more	1	1	1	0

Table 18

Frequency of Students by Academic Discipline Making Procedural Information Statements

	Academic Discipline			
Number of Occurrences	English	Social Studies	Marketing	Stenography
None	13	7	19	25
1-3	11	8	22	5
4 or more	5	3	6	1

Table 19

Frequency of Students by Academic Discipline Reading Aloud

	Academic Discipline			
Number of Occurrences	English	Social Studies	Marketing	Stenography
None	24	6	36	29
1-3	5	9	10	2
4 or more	0	3	1	0

Table 20

Frequency of Students by Academic Discipline Doing Writing

	Academic Discipline			
Number of Occurrences	English	Social Studies	Marketing	Stenography
None	26	7	43	30
1-3	2	9	1	0
4 or more	1	2	3	1

Table 21

Frequency of Students by Academic Discipline Showing Positive Affect

	Academic Discipline			
Number of Occurrences	English	Social Studies	Marketing	Stenography
None	23	8	42	27
1-3	6	10	5	4
4 or more	0	0	0	0

Table 22

Frequency of Students by Academic Discipline Showing Off Task Behavior

	Academic Discipline			
Number of Occurrences	English	Social Studies	Marketing	Stenography
None	12	17	32	21
1-3	12	1	11	6
4 or more	5	0	4	4

Table 23

Frequency of Students by Type of Teacher Activity Making Procedural Information Statements

	Type of Teaching Action		
Number of Occurrences	Whole Class Teaching	Individual Teaching	Other
None	7	71	10
1 or more	10	25	2

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